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Research Article

## Local Health Traditions, Cultural Reflections and Ethno-taxonomical Information on Wild Edible Fruit Yielding Medicinal Plants in Melur Region of Madurai District, TamilNadu, India

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### Abstract

Revitalization of local health traditions (RLHT) has become an inevitable aspect of human wellbeing in the post COVID era. An ethnobotanical survey was carried out to collect information on local health traditions and cultural reflections associate with the age old use of wild edible fruits (WEFs) from common plants in Melur Region of Madurai district, TamilNadu, India as the habit of consuming WEFs is quite common among people in this region and has not been completely abandoned in particular among the age old people. Information presented in this paper has been gathered from local people using an integrated approach of botanical collections, group discussions and interviews with questionnaires during the period from Apr 2021 to Mar 2022. As much as 29 informants were interviewed, among the informants 6 were local health-care practitioners (*Vidyars*). Studies on the use of WEFs from common plants in Melur resulted in collection and documentation of information on a total of 34 ethnomedicinal plant species distributed across 20 families. Medicinal plants used by local people are listed with scientific name, family, local name, plant part(s) used, mode of consumption and preparation and medicinal uses. Data collected during the study clearly indicates that fresh parts of the plant (Fruit (Ripe/ Unripe)) were more preferred in general for the preparation of medicinal formulations by the local health practitioners. Documented ethnomedicinal plants were mostly used to cure long term complications associated with diabetes, gastrointestinal disorders, skin diseases, poison bites and nervous disorders. However, results of this study is clear record to the claim that the local people still depend on medicinal plants to overcome situations like COVID pandemic as fruits from most of the plants documented serve as natural source of immune boosters. Further, in-depth studies (both *In-silico* and Pre Clinical trials) are expected to bring to limelight the hidden quantum of bioactive compounds in the fruits these medicinal plants and their therapeutic potential.

**Keywords:** RLHT; Medicinal Plants; Folklore Medicine; Wild Edible Fruits (WEFs); Ethnobotany

## INTRODUCTION

A growing global population, combined with factors such as depleting resources, climate change, changing socio-demographics, will place increased pressure on the world's natural resources to provide not only more but also different types of food. In particular, changing scenario in the Post COVID arena has forced the return of local health tradition as integral aspect of local cultural reflections among the people.<sup>1</sup> Increase in consumption of plant based natural products (PBNPs) and resultant market demand due to change in consumer behavior has been common in recent times.<sup>2</sup> In particular, changes in food consumption pattern with reference to local vegetables and fruits to boost the immunity has been witnessed in the post COVID era.<sup>3</sup> Wild Edible Fruits (WEFs) refers to edible fruit species which are not generally cultivated but have been and are collected from their natural habitats.<sup>4</sup> WEFs are still consumed by a large section of global population in the remote/ rural places as affordable food with incomparable source of nutritional security.<sup>5,6</sup> WEFs are nutrient-dense sources of vitamins, minerals, antioxidants and serve as a vital source of food, and healthcare among rural

people in the remote.<sup>4</sup> Ethnic groups across the world are known for their indigenous cultures, customs, religious rituals, myths, medicine, food and many other folklore practices that are largely unique and endemic to a particular region.<sup>7</sup> Local people dwelling in the forests and near are the repository of accumulated experience and of knowledge the indigenous vegetation.<sup>8</sup> Documentation of traditional knowledge and indigenous practices that have evolved over a period of time has gained prominence in recent time as latent aspect of "bioprospecting" resupply of pharmacologically active plant-derived natural products.<sup>9</sup> Food and medicine have been the integral part of life from time immemorial and man has been harnessing plants in the wild to satisfy his needs.<sup>10,11</sup> Although the quantity rather than quality of health services has been the focus historically in developing countries, ample evidence suggests that quality of care must be addressed for better health. In such remote places food and medical are more readily available to the people from the wild in the underdeveloped and less accessible areas of the nation and elsewhere with similar situations. Food with mineral deficiency and lack of apt/ proper medical facilities as in the urban are less common in the remote rural setup, in particular

in the developing countries. In such places WEFs are consumed as supplementary food however, sometimes even as medicines.<sup>12,13</sup> Fruits in particular the wild ones are nature's gift to mankind; they are not only delicious and refreshing, but also nutritionally rich and supplement human diet. Plant-based food and fruits are a recent, growing trend setting out to be a challenge<sup>14</sup>. However, food industry stakeholders need to be aware of the challenges and opportunities in this sector.

India is one of the twelve mega biodiversity hot spots of the world and has rich diversity of about 17,000 flowering plants<sup>15</sup>. Among the 25 hotspots in the world, the Eastern Himalayas and Western Ghats are the two prime tropical hotspots of India<sup>16</sup>. The state of TamilNadu situated on eastern side of Indian Peninsula at the point of culmination of the Western Ghats and the Eastern Ghats is blessed with splendid diversity of medicinal plants. The state has 32 districts and includes more than 427 groups of local ethnic communities distributed across the state<sup>17</sup>. Literature provides ample evidence as a record of publications pertaining to the richness of diversity and the usage of medicinal plants in this area by various ethnic groups. Ethnobotanical studies of two groups of Valaiyans, residing in the Vellimalli hills and Seithur hills respectively<sup>18</sup>. The aim of the present study is to collect and document the ethno-taxonomical information on WEFs yielding medicinal plants in Melur region of Madurai district, TamilNadu, India

## THE STUDY AREA

The area of investigation (Melur region, Madurai district) lies approximately between 77°30' and 78°20' longitude and 10°05' and 10°09' latitude. The elevation of the area ranges from 1000 to 3000 feet MSL. Variations in the altitude and rainfall have a bearing on the vegetation in general. The floristic divisions of the area of investigation consist of dry deciduous forest, deciduous thorn forest, evergreen and grasslands. Melur lies between two hills: "Vellaimalai" to the southern side of the area of investigation and "Sennamalai" to Northern side. The investigation was carried out for 12 months from Mar 2021- Apr 2022.

## METHODOLOGY

Ethnomedicinal information was gathered by contacting the local marutuvar (06), the headman and other local elderly persons (23) with in-depth knowledge of local medicinal plants. Information gathered was confirmed by different groups of people dwelling in different places of the area of investigation. Methodology of previous workers was

adopted<sup>18</sup>. Data was meticulously entered in a field notebook. Voucher specimens were collected and identified by referring to standard flora<sup>19,20</sup>.

## RESULTS

In early times mankind developed, through observation and experience, knowledge of the properties of plants as a source of food and medicines. Although food and medical facilities are more readily available to most of the people in our times, still in several underdeveloped and less accessible areas of the country food deficiency and lack of medical facilities are prevalent. A list of medicinal plants with their binomial, family, vernacular name, useful parts and medicinal uses is provided below. Ethnomedicinal uses of medicinal plant species by the local people in the Melur region of Madurai district, Tamil Nadu, India have been documented. A total of 34 medicinal plant species viz., *Anacardium occidentale* Linn.; *Mangifera indica* L.; *Annona muricata* L.; *Annona reticulata* L.; *Annona squamosa* Linn.; *Carissa carandas* L.; *Borassus flabellifer* L.; *Phoenix sylvestris* L.; *Ehretia microphylla* Lam.; *Opuntia dillenii* Haw.; *Carica papaya* L.; *Pithecellobium dulce* Roxb.; *Tamarindus indica* L.; *Citrullus lanatus* Thunb.; *Coccinia indica* L.; *Phyllanthus reticulatus* L.; *Phyllanthus acidus* L.; *Phyllanthus emblica* L.; *Artocarpus heterophyllus* Lam.; *Ficus glomerata* Roxb.; *Musa paradisiaca* L.; *Psidium guajava* Linn.; *Syzygium cumini* L.; *Punica granatum* L.; *Ziziphus oenoplia* Mill.; *Zizyphus jujube* Lam.; *Morinda tinctoria* Roxb.; *Citrus limon* (L) Burm. F.; *Citrus medica* L.; *Aegle marmelos* (L) Correa; *Feronia elephantum* Correa; *Manilkara zapota* L.; *Solanum nigrum* L.; *Physalis minima* L. belonging to 20 families of angiosperms (Ceasalpinaeae Myrtaceae Boraginaceae Cucarbitaceae Apocynaceae Punicaceae Anacardiaceae Poaceae Moraceae Annonaceae Rhamnaceae Rutaceae Solanaceae Caricaceae Cactaceae Musaceae Sapotaceae Rubiaceae Arecaceae Euphorbiaceae) were collected from the field during the study (Table 1). All the collected medicinal plant species could be classified in four main categories (Herb, Climber, Tree, and Shrub) based on their habit (Fig. 2). These medicinal plants were either collected from the wild or sometime from the fields (cultivated), only few plants were both collected from the wild as well as field collected (Fig. 3). Further, based on the type of fruit the plants were grouped in Pepo, Berry, Drupe and Legume bearing plants (Fig. 4). Usage pattern of the fruits obtained from medicinal plants enlisted in the study could be categorised into Raw, Cooked, Pickled, Raw/ Pickled, Raw/ Cooked, Raw/ Cooked/ Pickled (Fig. 5). Their local use for treatment of various diseases is presented in Table 2.

## Enumeration to the medicinal plants collected during the study

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Sapindales
<b>Family</b>	:	Anacardiaceae.
<b>Genus</b>	:	<i>Anacardium</i>
<b>Species</b>	:	<i>Anacardium occidentale</i> L.
<b>Plant Description</b>	:	Trees or shrubs, 4-10 m tall; branchlets glabrous to sub-glabrous. Petiole 1-1.5 cm; leaf blade obovate, 8-11 × 6-8.5 cm, leathery, glabrous on both sides, base broadly cuneate, margin entire, apex rounded, truncate to retuse, lateral veins ca. 12 pairs, reticulate venation pattern prominent on both sides. Inflorescence paniculate, 10-20 cm, glabrous to densely greyish sericeous; floral subtending bracts ovate-lanceolate, 5-10 mm, keeled, greyish sericeous abaxially, glabrous adaxially. Flower sessile to shortly pedicellate. Calyx greyish sericeous abaxially, ca. 4 × 1.5 mm. Petals 5, greenish yellow to red, linear-lanceolate, 7-9 × ca. 1.2 mm, greyish sericeous abaxially,

minutely pubescent to sub-glabrous adaxially. Stamens 7-10, larger one 8-9 mm in male flowers, 5-6 mm in bisexual flowers, sterile stamens 3-4 mm. Ovary ca. 2 mm, glabrous; style 4-5 mm. Fleshy hypocarp 3-7 × 4-5 cm, purplish red at maturity; drupe reniform, 2-2.5 × ca. 1.5 cm. Fl. Mar-Apr, fr. Jul-Aug.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Rosanae  
**Order** : Sapindales  
**Family** : Anacardiaceae  
**Genus** : *Mangifera*  
**Species** : *Mangifera indica* L.  
**Plant Description** : Trees, 10-20 m tall; branchlets brown, glabrous. Petiole 2-6 cm, grooved apically, inflated basally; leaf blade oblong to oblong-lanceolate, 12-30 × 3.5-6.5 cm, leathery, deep green adaxially, light green abaxially, glabrous on both sides, base cuneate to obtuse, margin entire, undulate, apex acute to long acuminate, lateral veins 20-25 pairs, midrib prominent on both sides, reticulate venation obscure. Inflorescence paniculate, terminal, 20-35 cm, glabrous to tomentose-pilose; bracts ca. 1.5 mm, lanceolate pubescent. Pedicels 1.5-3 mm, articulate. Sepals ovate-lanceolate, 2.5-3 × ca. 1.5 mm, glabrous to pubescent, acuminate. Petals light yellow with prominent red tree-shaped pattern adaxially, oblong or oblong-lanceolate, 3.5-4 × ca. 1.5 mm, glabrous, recurved at anthesis. Fertile stamen 1, ca. 2.5 mm, with ovate anther; staminodes 4, 0.7-1 mm. Disk inflated, fleshy, 5-lobed. Ovary oblique, ovate, ca. 1.5 mm in diam. at anthesis; style ca. 2.5 mm, eccentric. Drupe oblong to subreniform, greenish yellow to red, 5-10 × 3-4.5 cm; fleshy mesocarp bright yellow; endocarp ± compressed. Fl. Mar-Apr, fr. May-Jul.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae.  
**Superorder** : Magnolianae  
**Order** : Magnoliales  
**Family** : Annonaceae.  
**Genus** : *Annona*  
**Species** : *Annona muricata* L  
**Plant Description** : Trees to 10 m tall, evergreen. Bark rugose. Petiole short; leaf blade obovate-oblong to ovate-elliptic, 5-18 × 2-7 cm, papery, abaxially greenish and glabrous, adaxially green and shiny, secondary veins 6-13 on each side of midvein and slightly prominent on both surfaces, base broadly cuneate to rounded, apex acute to obtuse. Inflorescences axillary, 1- or 2-flowered. Flowers ca. 3.8 cm in diam. Pedicel 0.5-2.5 cm, pubescent. Sepals ovate-elliptic to ovate-triangular, 3-5 mm. Petals green, later yellowish, inside basally without a red spot; outer petals thick, broadly triangular, 2.5-5 × 2-4 cm, inside finely pubescent, apex acute to obtuse; inner petals ovate-elliptic, 2-4 × 1.5-3.5 cm, slightly thin, imbricate, pubescent, base clawed, apex obtuse. Stamens 4-5 mm; filaments fleshy; connectives apically dilated. Carpels ca. 5 mm, pubescent. Syncarp green, ovoid and often oblique or curved, 10-35 × 7-15 cm, covered with soft prickles, base impressed, apex rounded; pulp white. Seeds brownish yellow, reniform, ca. 2 × 1 cm. Fl. Apr-Jul, fr. Jul-Dec

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Magnolianae  
**Order** : Magnoliales  
**Family** : Annonaceae  
**Genus** : *Annona*  
**Species** : *Annona reticulata* L  
**Plant Description** : Trees to 6 m tall, evergreen. Branchlets greyish sericeous, glabrescent. Axillary leaf buds ovoid, apex obtuse. Petiole 1-1.5 cm; leaf blade oblong-lanceolate, 9-30 × 2-7 cm, papery, pubescent when young but glabrescent, secondary veins 9-18 on each side of mid-vein, forming an angle of 30°-60° with mid-vein, and flat, base cuneate to obtuse and slightly decurrent onto petiole, apex acuminate. Inflorescences leaf-opposed or inter-nodal, cymose, several flowered. Flower buds lanceolate, apex obtuse. Sepals ovate, 2-3 mm, outside pubescent, inside glabrous. Petals yellowish green; outer petals oblong-lanceolate, fleshy, outside puberulent, inside glabrous;

inner petals absent. Stamens oblong, 1-1.3 mm; connectives apically subtruncate. Carpels oblong, villous; stigmas muriculate. Syncarp turning yellow to reddish, spherical to ovoid, 5-12.5 cm in diam.; areoles  $\pm$  flat, separated by a reticulation of often raised ridges; pulp yellowish. Seeds blackish brown. Fl. Nov-Feb, fr. Mar-Jun

<b>Class</b>	: Equisetopsida
<b>Subclass</b>	: Magnoliidae
<b>Superorder</b>	: Magnolianae
<b>Order</b>	: Magnoliales
<b>Family</b>	: Annonaceae.
<b>Genus</b>	: <i>Annona</i>
<b>Species</b>	: <i>Annona squamosa</i> Linn.
<b>Plant Description</b>	: Trees, deciduous, to 8 m tall. Bark thin. Branchlets pubescent, glabrescent. Petiole 4-15 mm; leaf blade elliptic-lanceolate, narrowly elliptic, or oblong, 5-17.5 $\times$ 2-7.5 cm, thinly papery to membranous, abaxially pale green and puberulent when young but glabrate in age, base obtuse to rounded and slightly decurrent, apex acute to obtuse, lateral veins 8-15 on each side of midvein, adaxially flat. Inflorescences 1-flowered or 2-4-fasciculate. Flowers 2-3 cm, puberulent. Sepals triangular. Outer petals basally green to purple, oblong-lanceolate, 1.5-3 $\times$ 0.5-0.8 cm, fleshy, thick, inside concave, keeled on apical half; inner petals absent or reduced to scales, as long as stamens. Stamens oblong, ca. 1 mm; connective broad, apex subtruncate. Carpels oblong, distinct at anthesis; stigmas ovate-lanceolate. Syncarp greenish yellow, slightly pruinose, spherical to ovoid, 5-10 cm in diam., areoles rounded, convex, separated by deep grooves; pulp white. Seeds black-brown, ca. 14 mm. Fl. May-Jul, fr. Jun-Nov

<b>Class</b>	: Equisetopsida
<b>Subclass</b>	: Magnoliidae
<b>Superorder</b>	: Asteranae
<b>Order</b>	: Gentianales
<b>Family</b>	: Apocynaceae
<b>Genus</b>	: <i>Carissa</i>
<b>Species</b>	: <i>Carissa carandas</i> L.
<b>Plant Description</b>	: Shrubs, small trees, or climbers to 5 m tall. Spines simple or forked, to 5 cm. Leaf blade broadly ovate to oblong, 3-7 $\times$ 1.5-4 cm, base broadly cuneate to rounded, apex short apiculate; lateral veins ca. 8 pairs, ascending, convergent, anastomosing near margin. Cymes terminal, usually 3-flowered; peduncle 1.5-2.5 cm; bracteoles minute. Flowers fragrant. Pedicel about as long as calyx or slightly longer. Sepals 2.5-7 mm, with many basal glands inside. Corolla white or pale rose; tube to 2 cm, puberulent inside; lobes lanceolate, ca. 1 cm, acute, overlapping to right, puberulent, ciliate. Ovules numerous in each locule. Berries reddish purple, ellipsoid, 1.5-2.5 $\times$ 1-2 cm. Fl. Mar-Jun, fr. Jul-Dec.

<b>Class</b>	: Equisetopsida
<b>Subclass</b>	: Magnoliidae
<b>Superorder</b>	: Lilianae
<b>Order</b>	: Arecales
<b>Family</b>	: Arecaceae
<b>Genus</b>	: <i>Borassus</i>
<b>Species</b>	: <i>Borassus flabellifer</i> L.
<b>Plant Description</b>	: <i>Borassus flabellifer</i> , commonly called palmyra palm, toddy palm or lontar palm, is a large fan palm that typically matures to 60' tall and to 25' wide featuring a straight solitary gray trunk (to 3' in diameter) ringed with leaf scars and a globose crown of rigid palmate leaves (each to 8-10' long) with spiny stalks. Palm is native to India, Sri Lanka and Malaya.

Solitary palm with rough and black stem, 20-25 (-30) m tall. Petiole 60-120 cm, semiterete, edges with hard irregular spines; leaf blade 60-120 cm long, segments 60-80, linear-lanceolate, induplicate. Male inflorescence 90-150 cm long, with c. 7 primary branches, secondary branches c. 30 cm long, c. 2 cm in diameter; sepals narrowly cuneate with truncate inflexed tips; petals shorter, obovate-spathulate; anthers subsessile, large; female inflorescence with flowering portion to 30 cm long, 2.5 cm in diameter, flowers 8-16, spirally arranged, c.

2.5 cm in diameter; sepals fleshy, reniform; petals smaller; ovary subtrigonous; stigmas sessile, recurved. Fruits broadly ovoid, 15-20 cm in diameter, mesocarp fibrous and fleshy. Pyrenes usually 3, obcordate, 6-7 mm broad, black.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Lilianae
<b>Order</b>	:	Arecales
<b>Family</b>	:	Arecaceae
<b>Genus</b>	:	<i>Phoenix</i>
<b>Species</b>	:	<i>Phoenix sylvestris</i> L.
<b>Plant Description</b>	:	Stems solitary or clustered, short and subterranean to large and aerial, usually rough with very close nodes, often covered with persistent leaf bases. Leaves 8-50, pinnate; leaf sheaths open; pinnae induplicate, regularly or irregularly arranged and then spreading in different planes, at base of leaf modified into short, stout, sharp spines (acanthophylls). Plants dioecious. Inflorescences usually branched to 1 order, borne among leaves; peduncle bearing a prophyll, other bracts much reduced; rachillae often borne in groups or spirals along inflorescence rachis; flowers small, simple, unisexual; male flowers with 6(-9) stamens. Fruits variously colored black or brown, obovoid, oblong, or ellipsoid, usually 1-seeded; mesocarp fleshy, thick and sweet tasting in date palm but thin and bitter in other species; endosperm homogeneous, rarely ruminate; germination remote; eophylls undivided.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Caryophyllanae
<b>Order</b>	:	Caryophyllales
<b>Family</b>	:	Cactaceae
<b>Genus</b>	:	<i>Opuntia</i>
<b>Species</b>	:	<i>Opuntia dillenii</i> (Ker Gawl.) Haw.
<b>Plant Description</b>	:	Shrubs sprawling or erect, 1-3 m tall. Trunk absent or short. Larger, terminal joints green to gray-green, obovate or elliptic-obovate to suborbicular, 10-35(-40) × 7.5-20(-25) cm. Areoles 2-9 mm in diam. Spines 1-12(-20) per areole on most areoles, spreading, yellow, ± brown banded or mottled, subulate, straight or curved, 1.2-4(-6) cm, basally flattened; glochids yellow. Leaves subulate, 4.5-6 mm, deciduous. Flowers 5-9 cm in diam. Sepaloids greenish with yellow margin, broadly deltoid-obovate to obovate, 10-25 × 6-12 mm, margin entire or slightly crisped, apex mucronate. Petaloids spreading, bright yellow, obovate or cuneate-obovate, 25-30 × 12-20 mm, margin entire or slightly undulate, apex rounded, truncate, or emarginate. Filaments yellow, ca. 12 mm; anthers yellow, ca. 1.5 mm. Style yellow or yellowish, 12-20 mm; stigmas 5, pale green, ca. 4.5 mm. Fruit purple, turbinate to obovoid, 4-6 × 2.5-3(-4) cm, fleshy at maturity, umbilicus deep. Seeds light tan, irregularly orbicular, 4-5 × 4-4.5 mm. Fl. Jun-Oct (-Dec) sometimes.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Brassicales
<b>Family</b>	:	Caricaceae
<b>Genus</b>	:	<i>Carica</i>
<b>Species</b>	:	<i>Carica papaya</i> L.
<b>Plant Description</b>	:	Trees or shrubs 8-10 m tall. Stem simple, with stipulate scars helically arranged. Petiole hollow, 60-100 cm; leaf blade ca. 60 cm, usually 5-9 palmatifid; lobes pinnatifid. Male inflorescence pendulous, to 1 m. Male flowers: pedicel absent; corolla tube creamy yellow, 1.6-2.5 cm, lobes lanceolate, ca. 1.8 × 0.45 cm; stamens 5 longer and 5 shorter, shorter ones almost without filaments; filaments white, white tomentose. Female flowers usually solitary or aggregated in corymbose cymes; pedicel short or nearly absent; calyx lobes ca. 1 cm; corolla lobes creamy yellow, oblong or lanceolate, 5-6.2 × 1.2-2 cm; ovary ovoid; stigmas partite, nearly fimbriate. Bisexual flowers: corolla tube 1.9-2.5 cm, lobes oblong, ca. 2.8 × 0.9 cm; stamens 5 or 10 in 1 or 2 whorls; ovary smaller than in female flowers. Fruit orange-yellow or yellow at maturity, cylindric, ovoid-cylindric, or subglobose, 10-

30 cm; sarcocarp soft with a mild, pleasant flavor. Seeds numerous, black at maturity, ovoid.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Cucurbitales
<b>Family</b>	:	Cucurbitaceae
<b>Genus</b>	:	<i>Coccinia</i>
<b>Species</b>	:	<i>Coccinia indica</i> Wight & Arn.
<b>Plant Description</b>	:	Herbs, climbing. Roots tuberous. Branches glabrous or slightly scabrous. Tendrils simple, rarely 2-fid. Leaf blade angled or divided. Plants dioecious or rarely monoecious. Male flowers solitary or in a cyme or raceme; calyx tube short, campanulate or turbinate; segments 5; corolla campanulate; segments 5; stamens 3, inserted at base of calyx tube; filaments connate; anthers connivent, one 1-celled, two 2-celled; anther cells reflexed; connective not produced. Female flowers solitary; calyx and corolla as in male flowers; staminodes 3, oblong or subulate; ovary ovoid, oblong, or linear; placentas 3; ovules numerous, horizontal; style filiform; stigma 3-lobed. Fruit ovoid or oblong, baccate, indehiscent. Seeds numerous, compressed, marginate.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Cucurbitales
<b>Family</b>	:	Cucurbitaceae
<b>Genus</b>	:	<i>Citrullus</i>
<b>Species</b>	:	<i>Citrullus lanatus</i> (Thunb.) Mansf.
<b>Plant Description</b>	:	Plants annual. Stem and branches robust, sulcate-angular, villous. Tendrils puberulent, 2-fid. Petiole 3-12 cm, densely pubescent; leaf blade white-green, triangulate-ovate, 8-20 × 5-15 cm, both surfaces hispid, 3-partite; segments lobulate, base cordate, sinus semicircular, apex acute or acuminate. Flowers solitary. Male flowers: pedicel 3-4 cm, villous; calyx tube densely villous; segments narrowly lanceolate, 2-3 mm; corolla pale yellow, 2.5-3 cm in diam.; segments ovate-oblong, 1-1.5 × 0.5-0.8 cm; stamens nearly free. Female flowers: calyx and corolla as in male flowers; ovary 5-8 mm, densely villous; stigmas 3, reniform. Fruit globose or oblong, smooth. Seeds numerous, color various, ovate, 1-1.5 × 0.5-0.8 cm. Fl. and fr. Apr-Oct.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Asteranae
<b>Order</b>	:	Lamiales
<b>Family</b>	:	Ehretiaceae
<b>Genus</b>	:	<i>Ehretia</i>
<b>Species</b>	:	<i>Ehretia microphylla</i> Lam
<b>Plant Description</b>	:	Trees or shrubs. Leaves petiolate, entire or serrate at margin. Inflorescences corymbose or paniculate-cymose. Calyx 5-lobed. Corolla white or pale yellow, tubular or tubular-campanulate, rarely funnelform, 5-lobed; lobes spreading or reflexed. Filaments usually exserted; anthers ovate to oblong or linear. Ovary ovoid, 2-loculed, each locule with 2 ovules. Style terminal, 2-cleft; stigmas 2, capitate or elongated. Drupes yellow, orange, or pale red, subglobose, glabrous, endocarp divided at maturity into 2 2-seeded or 4 1-seeded pyrenes.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Fabales
<b>Family</b>	:	Fabaceae

<b>Genus</b>	: <i>Pithecellobium</i>
<b>Species</b>	: <i>Pithecellobium dulce</i> (Roxb.) Benth
<b>Plant Description</b>	: Trees, evergreen. Branches often pendulous; branchlets armed with spinescent stipules. Pinnae 1 pair; glands at junction of pinnae and leaflets; leaflets sessile, 1 pair per pinna, elliptic or obovate-elliptic, 2-5 × 0.2-2.5 cm, both surfaces glabrous, reticulate veins raised abaxially, base slightly oblique, apex obtuse or emarginate. Inflorescence pedunculate heads, aggregated in terminal panicles. Calyx funnel-shaped, 1-1.5 mm, to-mentose. Corolla ca. 6 mm. Stamens numerous, connate into a tube at base. Legume blackish brown, curved into a circle, flat, 5-7 cm in diam. Seeds dark brown, shiny, ovoid-ellipsoid, ca. 1.5 cm, hard, with pleurogram. Fl. Mar-Jun, fr.
<b>Class</b>	: Equisetopsida
<b>Subclass</b>	: Magnoliidae
<b>Superorder</b>	: Rosanae
<b>Order</b>	: Fabales
<b>Family</b>	: Fabaceae
<b>Genus</b>	: <i>Tamarindus</i>
<b>Species</b>	: <i>Tamarindus indica</i> L.
<b>Plant Description</b>	: Trees, 10-15(-25) m tall. Trunk 30-50(-90) cm d.b.h. Bark dark ashy, irregularly longitudinally splitting. Leaflets ob-long, small, 1.3-2.8 cm × 5-9 mm, glabrous, base obliquely rounded, apex rounded or emarginate. Flowers few, yellowish tinged with purplish red stripes; peduncles and pedicels yellowish green puberulent; bracteoles 2, ca. 1 cm, enclosing flower bud before anthesis. Calyx tube ca. 7 mm; lobes lanceolate-oblong, ca. 1.2 cm, reflexed after anthesis. Petals obovate, sub-equal to calyx lobes, margin repand, curled. Stamens 1.2-1.5 cm, pubescent near base, free parts of filaments ca. 7 mm; anthers elliptic, ca. 2.5 mm. Ovary slightly incurved, terete, ca. 8 mm, hairy. Legume brownish, straight or arcuate, terete-oblong, turgid, 5-14 cm, often irregularly constricted. Seeds 3-14, brownish, shiny. Fl. May-Aug, fr. Dec-May
<b>Class</b>	: Equisetopsida
<b>Subclass</b>	: Magnoliidae
<b>Superorder</b>	: Rosanae
<b>Order</b>	: Myrales
<b>Family</b>	: Lythraceae
<b>Genus</b>	: <i>Punica</i>
<b>Species</b>	: <i>Punica granatum</i> L.
<b>Plant Description</b>	: Shrubs or small trees, 2-3 m tall, glabrous. Branches and branchlets 4-angled, becoming terete with age, often terminating as indurate spines. Petiole 2-10 mm; leaf blade adaxially shiny, lanceolate, elliptic-ob lanceolate, or oblong, 2-9 × 1-2 cm, base attenuate, apex obtuse or mucronate. Floral tube red-orange or pale yellow, campanulate-urceolate, 2-3 × 1-1.5 cm; sepals 5-9, erect, deltate. Petals 5-9, bright red-orange [or white], obovate, 1.5-3 × 1-2 cm, apex rounded or obtuse. Stamens numerous, included to exserted. Ovary 8-13-loculed, in 2 or 3 superposed layers, lower locules with axile placentation, upper ones with apparent parietal placentation. Fruit globose, leathery berries, variable in color, red to yellow-green or red-brown, 5-12 cm in diam., crowned by persistent sepals, irregularly dehiscent. Seeds obpyramidal within juicy sarcotestal layer, ruby-red, pink, or yellowish white. Fl. Mar-Jul.
<b>Class</b>	: Equisetopsida
<b>Subclass</b>	: Magnoliidae
<b>Superorder</b>	: Rosanae
<b>Order</b>	: Rosales
<b>Family</b>	: Moraceae
<b>Genus</b>	: <i>Ficus</i>
<b>Species</b>	: <i>Ficus glomerata</i> Roxb.
<b>Plant Description</b>	: Trees, 25-30 m tall, d.b.h. 60-90 cm; monoecious. Bark greyish brown, smooth. Branchlets, young leaf blades, and figs with bent hairs or densely covered with white soft pubescence. Branchlets brown. Stipules ovate-lanceolate, 1.5-2 cm, membranous, pubescent. Leaves alternate; petiole 2-3 cm; leaf blade elliptic-obovate, elliptic, or narrowly elliptic, 10-14 × 3-4.5(-7) cm, ± leathery, abaxially pale green, pubescent when young,

glabrescent, and  $\pm$  scabrous, adaxially dark green and glabrous, base cuneate to obtuse, margin entire, apex acuminate to obtuse; basal lateral veins 2, secondary veins 4-8 on each side of midvein. Figs in a tumor like aggregate on short branchlets of old stem, occasionally axillary on leafy shoot or on older leafless branchlets, paired, reddish orange when mature, pear-shaped, 2-2.5 cm in diam., basally attenuated into a stalk, apical pore navel-like, flat; peduncle ca. 1 cm; involucral bracts triangular-ovate. Male, gall, and female flowers within same fig. Male flowers: near apical pore, sessile; calyx lobes 3 or 4; stamens 2. Gall and female flowers: pedicellate; calyx lobes linear, apex 3- or 4-toothed; style lateral; stigma clavate. Fl. May-Jul.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Rosanae  
**Order** : Rosales  
**Family** : Moraceae  
**Genus** : *Artocarpus*  
**Species** : *Artocarpus heterophyllus* Lam.  
**Plant Description** : Trees 10-20 m tall, d.b.h. 30-50 cm, evergreen. Mature trees with tubular roots. Bark blackish brown, thick. Branchlets furrowed to smooth, 2-6 mm thick, glabrous. Stipules amplexicaul, ovate, 1.5-8 cm, with or without bent pubescence, caducous, scar annular and conspicuous. Leaves spirally arranged; petiole 1-3 cm; leaf blade elliptic to obovate, 7-15(or more)  $\times$  3-7 cm, lobed on new growth of young trees, leathery, abaxially pale green and with scattered globose to ellipsoid resin cells, adaxially dark green, glabrous, and shiny, base cuneate, margin of mature leaves entire, apex blunt to acuminate; midvein abaxially conspicuously prominent, secondary veins 6-8 on each side of midvein; leaves on mature trees entire. Inflorescences on old stems or brachyblasts. Male inflorescences axillary on apical branchlet, sometimes axillary on axillary brachyblasts, cylindric to conic-ellipsoid, 2-7 cm, many-flowered but some sterile; peduncle 1-5 cm. Female inflorescences with a globose fleshy rachis. Male flowers: calyx tubular, apically 2-lobed, 1-1.5 mm, pubescent; filament straight in bud; anther ellipsoid. Female flowers: calyx tubular, apically lobed; ovary 1-celled. Fruiting syncarp pale yellow when young, yellowish brown when mature, ellipsoid, globose, or irregularly shaped, 30-100  $\times$  25-50 cm, with stiff hexagonal tubercles and thick hairs. Drupes narrowly elliptic, ca. 3  $\times$  1.5-2 cm. Fl. Feb-Mar.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Lilianae  
**Order** : Zingiberale  
**Family** : Musaceae  
**Genus** : *Musa*  
**Species** : *Musa paradisiaca* L.  
**Plant Description** : Pseudostems clumped, yellow-green, often with large, black markings, ca. 6 m. Petiole 60-75 cm, margin open, ca. 2 cm wide, often closed when young; leaf blade adaxially green and slightly pruinose or not, ovate-oblong, ca. 2.9 m  $\times$  90 cm, base auriculate, asymmetric. Inflorescence pendulous, ca. 2.5 m; peduncle and rachis glabrous. Bracts of bisexual and male flowers adaxially purple-red, abaxially brownish purple to yellow-green and pruinose, ovate to lanceolate, persistent, apex obtuse, reflexed after flowering; bracts of female flowers deciduous. Male flowers up to 20 per bract, in 2 rows. Compound tepal adaxially pale purple, abaxially pale purple-white, 4-5 cm, striate, teeth yellow to orange; free tepal milky white, translucent, obovate, ca. 1/2 as long as compound tepal, apex emarginate, shortly mucronate-apiculate. Infructescence pendulous, with ca. 8 clusters ("hands") each of 15 or 16 berries in 2 rows. Berries gray-green, obovoid, ca. 13  $\times$  4 cm, distinctly angled at maturity, base narrowed into a stalk ca. 2.5 cm, apex contracted or not into a short, angled column ca. 2 cm. Seeds numerous, brown, oblate, 5-10 mm in diam., minutely warty.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Rosanae  
**Order** : Myrtales  
**Family** : Myrtaceae  
**Genus** : *Psidium*

**Species** : *Psidium guajava* L.  
**Plant Description** : Trees, to 13 m tall. Bark gray, smooth, peeling in strips. Branchlets angular, pubescent. Petiole ca. 5 mm; leaf blade oblong to elliptic, 6-12 × 3.5-6 cm, leathery, abaxially pubescent, adaxially slightly rough, secondary veins 12-15 on each side of midvein and usually impressed, reticulate veins obvious, base rounded, apex acute to obtuse. Flowers solitary or 2 or 3 in cymes. Hypanthium campanulate, ca. 5 mm, pubescent. Calyx cap nearly rounded, 7-8 mm, irregularly opening. Petals white, 1-1.4 cm. Stamens 6-9 mm. Ovary adnate to hypanthium. Style as long as stamens. Berry globose, ovoid, or pyriform, 3-8 cm, with persistent calyx lobes at apex; flesh white or yellow; placenta reddish, well developed, fleshy. Seeds many. Fl. summer.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Rosanae  
**Order** : Myrtales  
**Family** : Myrtaceae  
**Genus** : *Syzygium*  
**Species** : *Syzygium cumini* (L.) Skeels  
**Plant Description** : Trees, 6-20 m tall. Branchlets greyish white when dry, terete. Petiole 1-2 cm; leaf blade broadly elliptic to narrowly elliptic, 6-12 × 3.5-7 cm, leathery, abaxially slightly pale when dry, adaxially brownish green to blackish brown and slightly glossy when dry, both surfaces with small glands, secondary veins numerous, 1-2 mm apart, and gradually extending into margin, intramarginal veins ca. 1 mm from margin, base broadly cuneate to rarely rounded, apex rounded to obtuse and with a short cusp. Inflorescences axillary on flowering branches or occasionally terminal, paniculate cymes, to 11 cm. Hypanthium obconic or long pyriform, ca. 4 mm or 7-8 mm. Calyx lobes inconspicuous, 0.3-0.7 mm. Petals 4, white or light purple, coherent, ovate and slightly rounded, ca. 2.5 mm. Stamens 3-4 mm. Style as long as stamens. Fruit red to black, ellipsoid to pot-shaped, 1-2 cm, 1-seeded; persistent calyx tube 1-1.5 mm. Fl. Feb-Mar or Apr-May, fr. Jun-Sep.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Rosanae  
**Order** : Malpighiales  
**Family** : Phyllanthaceae  
**Genus** : *Phyllanthus*  
**Species** : *Phyllanthus reticulatus* Poir.  
**Plant Description** : Shrubs to 4 m tall, monoecious; branches brownish; young branchlets, leaves, and pedicels yellowish pubescent or puberulent or glabrous. Stipules subulate-lanceolate, brown, 1-3 mm, hard and spiny when dry; petiole 2-5 mm; leaf blade varying in shape, mostly elliptic to ovate, 1-5(-6.5) × 0.7-3 cm, membranous to papery, base obtuse to rounded, apex acute or obtuse to rounded; lateral veins 5-7 pairs, usually prominent on both surfaces. Inflorescence an axillary fascicle, rarely a cyme, with 2-10 male and 1 or 2 female flowers. Male flowers: pedicels delicate, 5-10 mm; sepals 5 or 6, in 2 series, ovate or obovate, unequal, 0.7-1.5 × 0.5-1.2 mm, entire; disk glands 5, scalelike, ca. 0.5 mm wide; stamens 5, erect, 3 with longer filaments coherent in a central column, 2 with shorter filaments, free; anthers triangular, longitudinally dehiscent. Female flowers: pedicels 4-8 mm, delicate; sepals 5 or 6, in 2 series, unequal, broadly ovate, 1-1.6 × 0.9-1.2 mm, puberulent inside at base; disk glands 5 or 6, oblong or obovate; ovary 4-12-celled, smooth; styles free, bifid at apex, lobes linear, revolute and connivent over top of ovary. Fruit a berry, globose to oblate, 4-6 mm wide, black and dark purplish at maturity, 4-12-celled, 8-16-seeded. Seeds trigonous, 1.6-2 mm, brown. Fl. Mar-Jun, fr. Jun-Oct.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Rosanae  
**Order** : Malpighiales  
**Family** : Phyllanthaceae  
**Genus** : *Phyllanthus*  
**Species** : *Phyllanthus acidus* (L.) Skeels

**Plant Description** : Trees 3-8(-23) m tall, to 50 cm d.b.h., monoecious, deciduous; bark brownish; main stems terete, sparsely lenticellate, with very reduced short shoots producing groups of leafy shoots; leafy shoots angular, tawny pubescent, at start of growing season often with poorly developed leaves and densely flowered, later with fewer flowers and better-developed leaves. Leaves distichous; stipules triangular-ovate, 0.8-1.5 mm, brown, margins entire or denticulate, ciliate; petiole 0.3-0.7 mm; leaf blade oblong or linear-oblong, 8-23 × 1.5-6 mm, papery to leathery, paler abaxially, green adaxially, drying reddish or brownish, base shallowly cordate and slightly oblique, margin narrowly revolute, apex truncate, rounded or obtuse, mucronate or retuse at tip; lateral veins 4-7 pairs. Fascicles with many male flowers and sometimes 1 or 2 larger female flowers. Male flowers: pedicels 1-2.5 mm; sepals 6, membranous, yellow, obovate or spatulate, subequal, 1.2-2.5 × 0.5-1 mm, apex obtuse or rounded, margin entire or shallowly denticulate; disk glands 6, subtriangular; stamens 3; filaments coherent into column, 0.3-0.7 mm; anthers erect, oblong, 0.5-0.9 mm, longitudinally dehiscent, apex mucronate. Female flowers: pedicels ca. 0.5 mm; sepals 6, oblong or spatulate, 1.6-2.5 × 0.7-1.3 mm, apex obtuse or rounded, thicker, margin membranous, ± lobate; ovary ovoid, ca. 1.5 mm, 3-celled; styles 3, (1-)2.5-4 mm, connate at base, deeply bifid, lobes divided at tip. Fruit a drupe, globose, 1-1.3 cm in diam., exocarp fleshy, pale green or yellowish white, endocarp crustaceous. Seeds reddish, 5-6 × 2-3 mm. Fl. Apr-Jun, fr. Jul-Sep.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Rosanae  
**Order** : Malpighiales  
**Family** : Phyllanthaceae  
**Genus** : *Phyllanthus*  
**Species** : *Phyllanthus emblica* L.  
**Plant Description** : Trees 3-8(-23) m tall, to 50 cm d.b.h., monoecious, deciduous; bark brownish; main stems terete, sparsely lenticellate, with very reduced short shoots producing groups of leafy shoots; leafy shoots angular, tawny pubescent, at start of growing season often with poorly developed leaves and densely flowered, later with fewer flowers and better-developed leaves. Leaves distichous; stipules triangular-ovate, 0.8-1.5 mm, brown, margins entire or denticulate, ciliate; petiole 0.3-0.7 mm; leaf blade oblong or linear-oblong, 8-23 × 1.5-6 mm, papery to leathery, paler abaxially, green adaxially, drying reddish or brownish, base shallowly cordate and slightly oblique, margin narrowly revolute, apex truncate, rounded or obtuse, mucronate or retuse at tip; lateral veins 4-7 pairs. Fascicles with many male flowers and sometimes 1 or 2 larger female flowers. Male flowers: pedicels 1-2.5 mm; sepals 6, membranous, yellow, obovate or spatulate, subequal, 1.2-2.5 × 0.5-1 mm, apex obtuse or rounded, margin entire or shallowly denticulate; disk glands 6, sub-triangular; stamens 3; filaments coherent into column, 0.3-0.7 mm; anthers erect, oblong, 0.5-0.9 mm, longitudinally dehiscent, apex mucronate. Female flowers: pedicels ca. 0.5 mm; sepals 6, oblong or spatulate, 1.6-2.5 × 0.7-1.3 mm, apex obtuse or rounded, thicker, margin membranous, ± lobate; ovary ovoid, ca. 1.5 mm, 3-celled; styles 3, (1-)2.5-4 mm, connate at base, deeply bifid, lobes divided at tip. Fruit a drupe, globose, 1-1.3 cm in diam., exocarp fleshy, pale green or yellowish white, endocarp crustaceous. Seeds reddish, 5-6 × 2-3 mm. Fl. Apr-Jun, fr. Jul-Sep.

**Class** : Equisetopsida  
**Subclass** : Magnoliidae  
**Superorder** : Rosanae  
**Order** : Rosales  
**Family** : Rhamnaceae  
**Genus** : *Ziziphus*  
**Species** : *Ziziphus oenopolia* (L.) Mill.  
**Plant Description** : Shrubs erect or scandent, spinose. Young branches densely ferruginous or yellow-brown pubescent; bark gray or gray-brown. Stipular spines 1, sometimes 2, one recurved and one erect, 3-4 mm; petiole 5-7 mm, densely yellow-brown pubescent; leaf blade ovate-oblong or ovate-lanceolate, 3-8 × 2-4 cm, papery, abaxially appressed pubescent to nearly villous, adaxially veins sparsely pubescent or glabrescent, 3-veined at base, veins prominent abaxially, conspicuously impressed adaxially, base usually ± asymmetric, sub-rounded, margin inconspicuously crenate, apex acute or acuminate. Flowers greenish yellow, few to 10 in axillary shortly pedunculate cymes. Pedicel ca. 2 mm, pilose. Sepals ovate-triangular, abaxially sparsely pilose to pubescent, adaxially glabrous, apex acute. Petals spatulate, clawed, enfolding stamens. Stamens slightly shorter than petals. Disk pentagonal, thick, fleshy, often 5-lobed. Ovary globose, glabrous, immersed in disk; style 2-branched. Drupe black, shiny, globose or obovoid-globose, small, 5-7 × 5-6 mm, base with persistent calyx tube, apex mucronulate; fruiting pedicel 3-4 mm, pilose; endocarp cartilaginous, ca. 2 mm; stone 1- or 2-seeded. Seeds shiny, globose. Fl. Aug-Sep, fr. Oct.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Rosales
<b>Family</b>	:	Rhamnaceae
<b>Genus</b>	:	<i>Ziziphus</i>
<b>Species</b>	:	<i>Zizyphus jujube</i> Lam
<b>Plant Description</b>	:	Trees small, rarely shrubs, deciduous, to 10 m tall, spinose or unarmed. Bark brown or gray-brown, with long reduced branches, without buds; branchlets (new branches) purple-red or gray-brown, flexuose, smooth, with 2 stipular spines or not; long spines erect, to 3 cm, stout; short spines recurved, developed from old branches; annual branchlets pendulous, green, solitary or 2-7-fascicled on short shoots. Stipular spines slender, caducous; petiole 1-6 mm, or to 1 cm on long shoots, glabrous or sparsely puberulent; leaf blade abaxially pale green, adaxially dark green, ovate, ovate-elliptic, or elliptic-oblong, 3-7 × 1.5-4 cm, papery, abaxially ± puberulent on major veins or glabrous, adaxially glabrous, 3-veined from base, base slightly asymmetric, subrounded, margin crenate-serrate, apex obtuse or rounded, rarely acute, mucronulate. Flowers yellow-green, bisexual, 5-merous, glabrous, solitary or 2-8 crowded in axillary cymes, shortly pedunculate. Pedicel 2-3 mm. Sepals ovate-triangular, adaxially distinctly keeled. Petals obovate, ca. as long as stamens, clawed at base. Disk orbicular, thick, fleshy, 5-lobed. Ovary basally slightly immersed in disk; style 2-cleft to half. Drupe red at maturity, turning red-purple, oblong or narrowly ovoid, 2-3.5 cm, (0.5-)1.5-2 cm in diam.; mesocarp fleshy, thick, sweet- or sour-tasting; stone acute or obtuse at both ends, 2-loculed, 1- or 2-seeded; fruiting pedicel 2-5 mm or longer. Seeds compressed-orbicular, ca. 1 × 0.8 cm, Fl. May-Jul, fr. Aug-Oct.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Asteranae
<b>Order</b>	:	Gentianales
<b>Family</b>	:	Rubiaceae
<b>Genus</b>	:	<i>Morinda</i>
<b>Species</b>	:	<i>Morinda tinctoria</i> Noronha
<b>Plant Description</b>	:	Evergreen shrubs or small trees, to 5 m tall, often fleshy; branches Sub quadrangular, glabrous. Leaves opposite or solitary opposite an inflorescence; petiole 5-20 mm, glabrous; blade fleshy, drying papery, elliptic-oblong, elliptic, or ovate, 10-25 × 5-13 cm, glabrous and shiny on both surfaces, base acute or acuminate, apex acute to obtuse; secondary veins 5-7 pairs, with pubescent domatia; stipules interpetiolar, free or shortly fused to petioles, broadly triangular to ovate, 4-16 mm, obtuse or rounded. Inflorescence solitary and leaf-opposed; peduncle 1-1.5 cm; head 1, oblong to subglobose, 5-10 mm in diam., many flowered; bracts absent. Flowers with hypanthia partially fused, distylous. Calyx glabrous or puberulent; limb subtruncate to truncate, 0.2-0.5 mm, sometimes in 1 to numerous flowers of a head with 1(-3) calycophylls, these white, narrowly elliptic to oblanceolate, 5-16 mm, obtuse to acute. Corolla white, funnel form, outside glabrous; tube ca. 15 mm, densely villous in throat; lobes 5, ovate-lanceolate, ca. 6 mm. Drupe white, irregularly ovoid to sub-globose, 2.5-5 cm. Drupes not distinguishable individually. Fl. and Fr. year-round.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Sapindales
<b>Family</b>	:	Rutaceae
<b>Genus</b>	:	<i>Citrus</i>
<b>Species</b>	:	<i>Citrus limon</i> (L.) Burm. f.
<b>Plant Description</b>	:	Small trees. Branches ± spiny. Young leaves and flower buds reddish purple. Leaf blade ovate to elliptic, 8-14 × 4-6 cm, margin conspicuously crenulate, apex usually mucronate. Flowers solitary or several in fascicles. Flowers bisexual or male by ± complete abortion of pistil. Calyx cup-shaped; lobes 4 or 5. Petals 1.5-2 cm, outside purplish, inside white. Stamens 20-25 or more. Ovary subcylindric or barrel-shaped; stigma clavate. Fruit yellow, ellipsoid to ovoid, narrowed at both ends, surface usually coarse and lemon scented, apex usually with a mammilla; pericarp thick, difficult to remove; sarcocarp in 8-11 segments, pale yellow, acidic. Seeds ovoid, small, apex acute; seed coat smooth; embryo usually solitary but sometimes numerous; cotyledons milky

white. Fl. Apr-May, fr. Sep-Nov.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Sapindales
<b>Family</b>	:	Rutaceae
<b>Genus</b>	:	<i>Citrus</i>
<b>Species</b>	:	<i>Citrus medica</i> L
<b>Plant Description</b>	:	Shrubs or small trees. Branches, leaf buds, and flower buds purplish when young. Branches with ca. 4 cm spines. Leaves simple or rarely 1-foliate; petiole short, not winged; leaf blade elliptic to ovate-elliptic, 6-12 × 3-6 cm or larger, margin serrate, apex rounded, obtuse, or rarely mucronate. Inflorescences axillary, ca. 12-flowered or sometimes flowers solitary. Flowers bisexual or sometimes male by ± complete abortion of pistil. Petals 5, 1.5-2 cm. Stamens 30-50. Ovary cylindrical; style long and thick; stigma clavate. Fruit pale yellow, elliptic to sub-globose, to 2 kg, surface coarse; pericarp white to pale yellow and soft within, thicker than sarcocarp, removed with difficulty; sarcocarp with 10-15 segments, colourless, nearly pellucid to pale milky yellow, acidic to slightly sweet, fragrant. Seeds small; seed coat smooth; embryo(s) solitary to several; cotyledons milky white. Fl. Apr-May, fr. Oct-Nov.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Sapindales
<b>Family</b>	:	Rutaceae
<b>Genus</b>	:	<i>Feronia</i>
<b>Species</b>	:	<i>Feronia elephantum</i> Corrêa
<b>Plant Description</b>	:	

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Rosanae
<b>Order</b>	:	Sapindales
<b>Family</b>	:	Rutaceae
<b>Genus</b>	:	<i>Aegle</i>
<b>Species</b>	:	<i>Aegle marmelos</i> (L.) Corrêa
<b>Plant Description</b>	:	Trees, deciduous, with straight axillary spines. Leaves alternate, odd-pinnately (1 or)3(or 5)-foliolate. Inflorescences terminal and axillary, loosely fasciculate or racemose and few flowered or flowers solitary. Flowers bisexual, fragrant. Calyx cup-shaped, 4- or 5-lobed. Petals 4 or 5, imbricate in bud. Stamens 30-50 or more; filaments short, subulate, distinct or irregularly coherent at base; anthers linear-lanceolate. Disk columnar or bell-shaped. Gynoecium 8-20-locules, syncarpous; ovules many per locule, in 2 rows; style short and thick; stigma capitate, cylindrical, or bluntly conic, longitudinally grooved. Fruit a berry, globose to ellipsoid to pyriform; exocarp thin, parenchymatous; mesocarp woody; endocarp fleshy, soft and pulpy, becoming hard and reddish orange when dry, composed largely of elongate sessile pulp vesicles which are lacking within seed locules. Seeds depressed ovoid, woolly when ripe, embedded in a clear glutinous substance that becomes hard when dry; seed coat fleshy; endosperm lacking; embryo solitary, straight; cotyledons ovate, plano-convex; hypocotyl partly included between cotyledons. Seeds ca. 8 mm. Fr. Oct.

<b>Class</b>	:	Equisetopsida
<b>Subclass</b>	:	Magnoliidae
<b>Superorder</b>	:	Asteranae

<b>Order</b>	: Ericales
<b>Family</b>	: Sapotaceae
<b>Genus</b>	: <i>Manilkara</i>
<b>Species</b>	: <i>Manilkara zapota</i> (L.) P. Royen
<b>Plant Description</b>	: Trees or shrubs. Leaves leathery to almost leathery, densely lateral veined; stipules early deciduous. Flowers axillary, clustered. Sepals 6, in 2 whorls. Corolla lobes 6, outside each with 2 lobular appendages. Stamens 6; staminodes 6, alternating with corolla lobes, ovate, apex acuminate, irregularly serrate, fimbriate to lobate. Ovary 6-14-locular. Fruit a berry, 1-6-seeded. Seeds compressed, scar lateral and elongate.
<b>Class</b>	: Equisetopsida
<b>Subclass</b>	: Magnoliidae
<b>Superorder</b>	: Asteranae
<b>Order</b>	: Solanales
<b>Family</b>	: Solanaceae
<b>Genus</b>	: <i>Solanum</i>
<b>Species</b>	: <i>Solanum nigrum</i> L.
<b>Plant Description</b>	: Herbs annual, erect, 25-100 cm, pubescent with simple hairs, unarmed. Stems often angular, sparsely pubescent. Petiole 2-5 cm; leaf blade ovate, 4-10 × 3-7 cm, pubescent or glabrescent, base cuneate, decurrent, entire or coarsely dentate, apex obtuse. Inflorescences extra-axillary umbels; peduncle 2-4 cm. Pedicel 0.8-1.2 cm. Calyx cup-shaped, 2-3 × 2-3 mm; lobes subdeltate, 0.5-1 × 1-1.5 mm, pubescent abaxially, ciliate. Corolla white, 8-10 mm; lobes ovate-oblong, 4-5 × 3-3.5 mm, pubescent abaxially, ciliate, spreading. Filaments 1-1.5 mm; anthers oblong, 2.5-3.5 mm. Style 5-6 mm. Fruiting pedicel strongly deflexed; fruiting calyx applied to berry. Berry dull black, globose, 8-10 mm in diam. Seeds discoid, ca. 2 mm in diam. Fl. May-Aug, fr. Jul-Nov.
<b>Class</b>	: Equisetopsida
<b>Subclass</b>	: Magnoliidae
<b>Superorder</b>	: Asteranae
<b>Order</b>	: Solanales
<b>Family</b>	: Solanaceae
<b>Genus</b>	: <i>Physalis</i>
<b>Species</b>	: <i>Physalis minima</i> L.
<b>Plant Description</b>	: Herbs annual. Roots fibrous. Stems prostrate or erect, pubescent with long many-celled hairs. Petiole 1-1.5 cm; leaf blade ovate or ovate-lanceolate, 2-3 × 1-1.5 cm, pubescent along veins, base cuneate, often oblique, margin entire, sinuate, or with a few coarse teeth, apex acuminate. Pedicel ca. 5 mm, pubescent. Calyx campanulate, 2.5-3 mm, pubescent; lobes deltate, short acuminate, densely ciliate. Corolla yellow, ca. 5 mm. Anthers light yellow, 1-1.5 mm. Fruiting pedicel less than 1 cm, pendulous. Fruiting calyx green, subglobose or ovoid, 1-1.5(-2) cm. Berry globose, ca. 6 mm in diam. Fl. summer, fr. autumn.

## DISCUSSION

Tribal and rural population of India is highly dependent on medicinal plants to meet their health-care needs. This has attracted the attention of several botanists and plant scientists who directed vigorous research towards the investigation of several medicinal plants; this has resulted in an extensive scientific literature. The studies on the ethnomedicinal lore of Seithur hills<sup>18</sup> revealed the use of 36 plant species belonging to 33 genera distributed over 24 families of flowering plants by Valaya tribals of Virudhunagar District, Tamilnadu. Out of these, 7 species were used for scabies and other skin diseases, 2 species for jaundice, 4 species for headache, 3 species for fever and one species for diabetes. Similarly, studies conducted on the ethnomedicinal plants used by the Valaiyans of Vellimalai hills<sup>18</sup> indexed 84 angiosperm plant species

belonging to 28 genera distributed over 40 families for the treatment of various disorders, such as wounds, cuts, stomach pain, diabetes, fever, eczema, dandruff, cold, body heat, poisonous bites. Nearly all the plants reported to be used by Valaiyans of Vellimalai hills were recorded in the present study. The ethnobotanical uses of 161 species of Angiospermic plants distributed over 139 genera representing 60 families were reported from Thottianiackans of Semmalai hills, Tiruchirapalli district; the uses of 119 plants for medicinal purposes were recorded. Most of the species described here as well as by various other authors from different regions as used by various tribes are common<sup>21-30</sup>, but used for different purposes<sup>31,32</sup>. Information on some very useful medicines known to the tribal or ethnic communities through the experiences of ages is usually passed on from generation to generation<sup>33-35</sup>. The diversity is under serious threat due to

habitat destruction, overexploitation, shifting cultivation and several anthropogenic and natural pressures.

## CONCLUSION:

Plant Based Natural Products, to-date is the central dogma to drug discovery and with recent trend in IoT coupled with developments in AI-ML based CADD technologies is sure to increase the success rate of novel therapeutic moieties. Overall, NPs will remain a major contributor to drug development and in the effort to curb global health challenges. Results of the present study clearly depict that the local people at regional level still depend on medicinal plants to overcome the situations like COVID pandemic, as the plants served as natural source of immune boosters. Therefore, it must be pointed out that local indigenous varieties of medicinal plants played a major role in the management of COVID-19 during the pandemic. This suggests that awareness about medicinal plants and conservation strategies for the sustainability of local ecosystems has to be popularized so that the diversity and local health traditional practices are conserved.

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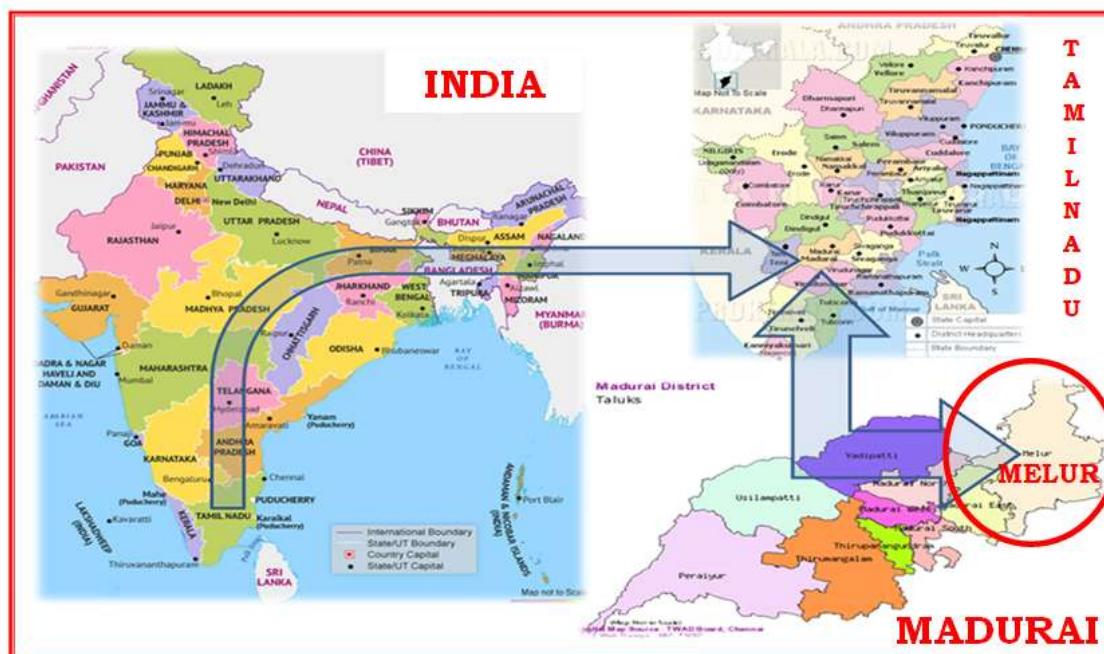


Figure 1: Study Area: Melur Region of Madurai District, India



**Figure 2** 1) *Anacardium occidentale* Linn.; 2) *Mangifera indica* L.; 3) *Annona muricata* L.; 4) *Annona reticulata* L.; 5) *Annona squamosa* Linn.; 6) *Carissa carandas* L.; 7) *Borassus flabellifer* L.; 8) *Phoenix sylvestris* L.; 9) *Ehretia microphylla* Lam; 10) *Opuntia dillenii* Haw.; 11) *Carica papaya* L.; 12) *Pithecellobium dulce* Roxb.; 13) *Tamarindus indica* L.; 14) *Citrullus lanatus* Thumb; 15) *Coccinia indica* L.; 16) *Phyllanthus reticulatus* L.; 17) *Phyllanthus acidus* L.; 18) *Phyllanthus emblica* L.; 19) *Artocarpus heterophyllus* Lam.; 20) *Ficus glomerata* Roxb.; 21) *Musa paradisiaca* L.; 22) *Psidium guajava* Linn.; 23) *Syzygium cumini* L.; 24) *Punica granatum* L.; 25) *Ziziphus oenoplia* Mill.; 26) *Zizyphus jujube* Lam.; 27) *Morinda tinctoria* Roxb.; 28) *Citrus limon* (L) Burm, F.; 29) *Citrus medica* L.; 30) *Aegle marmelos* (L) Correa; 31) *Feronia elephantum* Correa; 32) *Manilkara zapota* L.; 33) *Solanum nigrum* L.; 34) *Physalis minima* L.

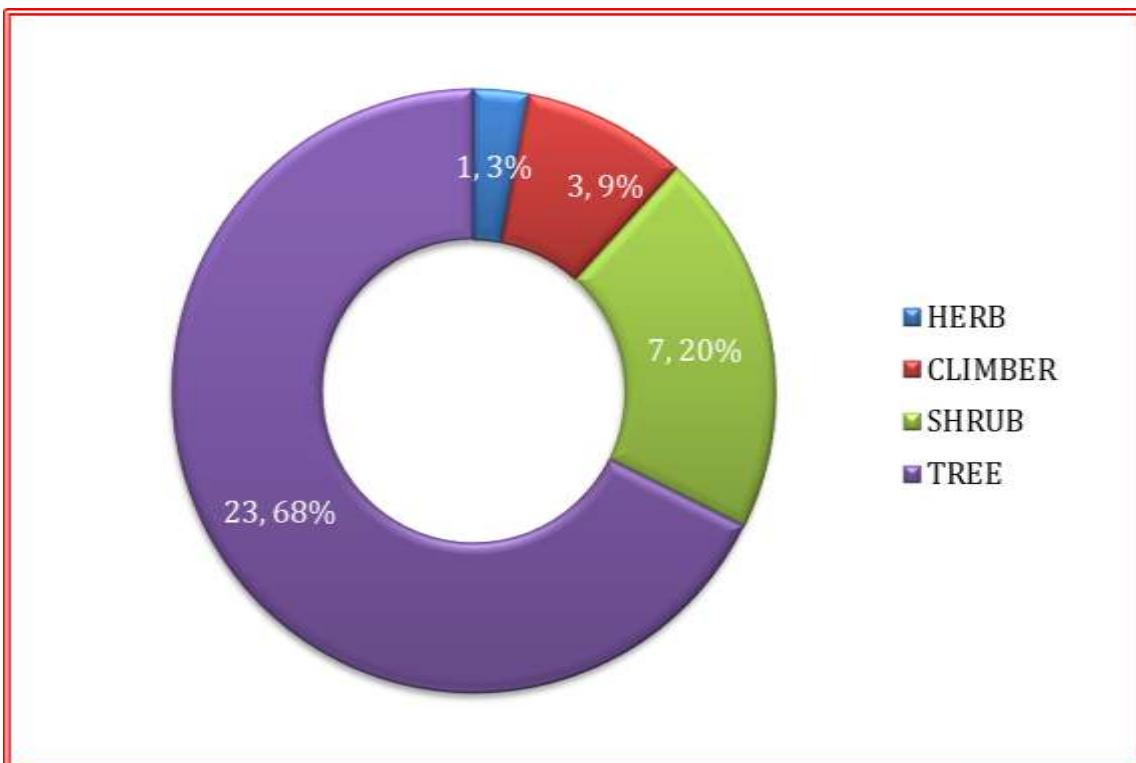


Figure 3: Habit wise percentage distribution of the WEF plants

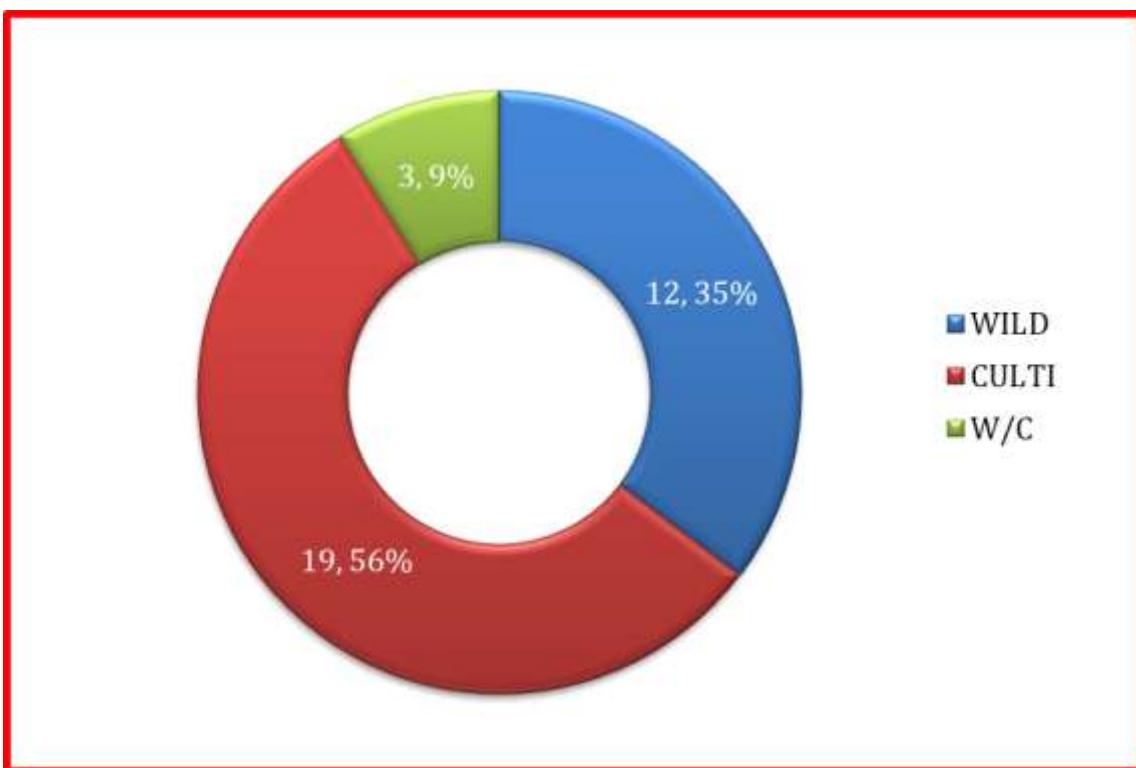


Figure 4: Cultivation status wise percentage distribution of WEF plants

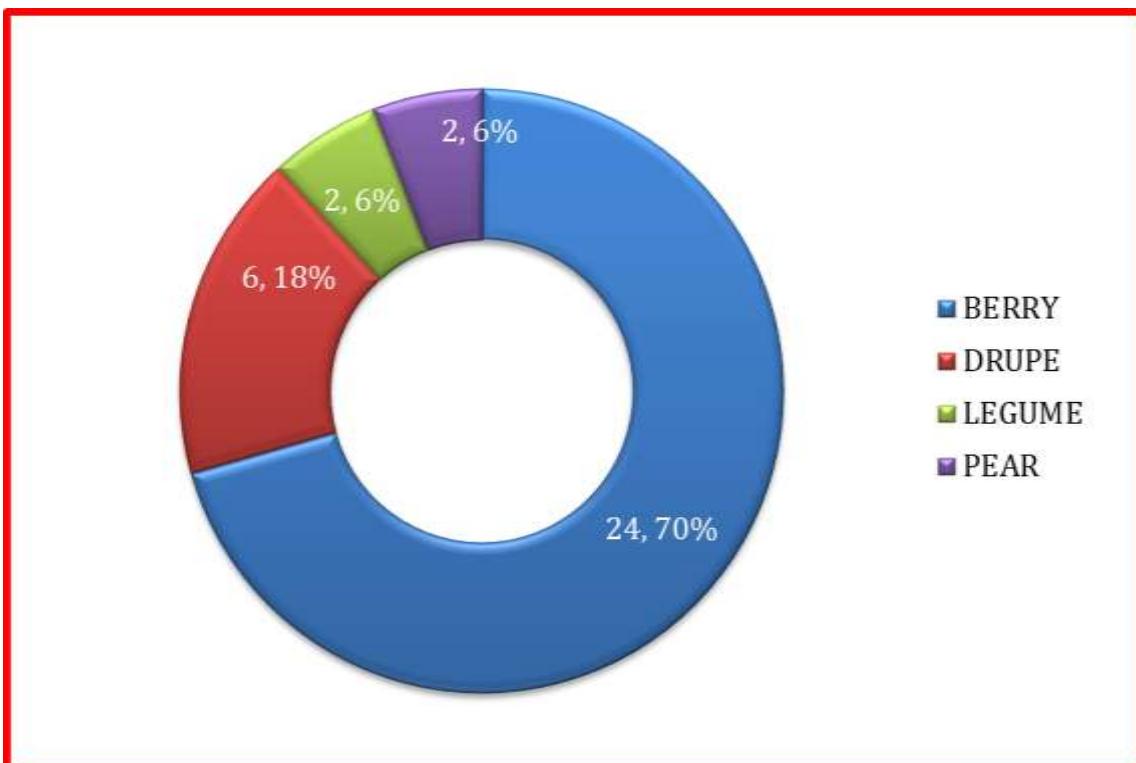


Figure 5: Type of fruit wise, percentage distribution of WEF plants

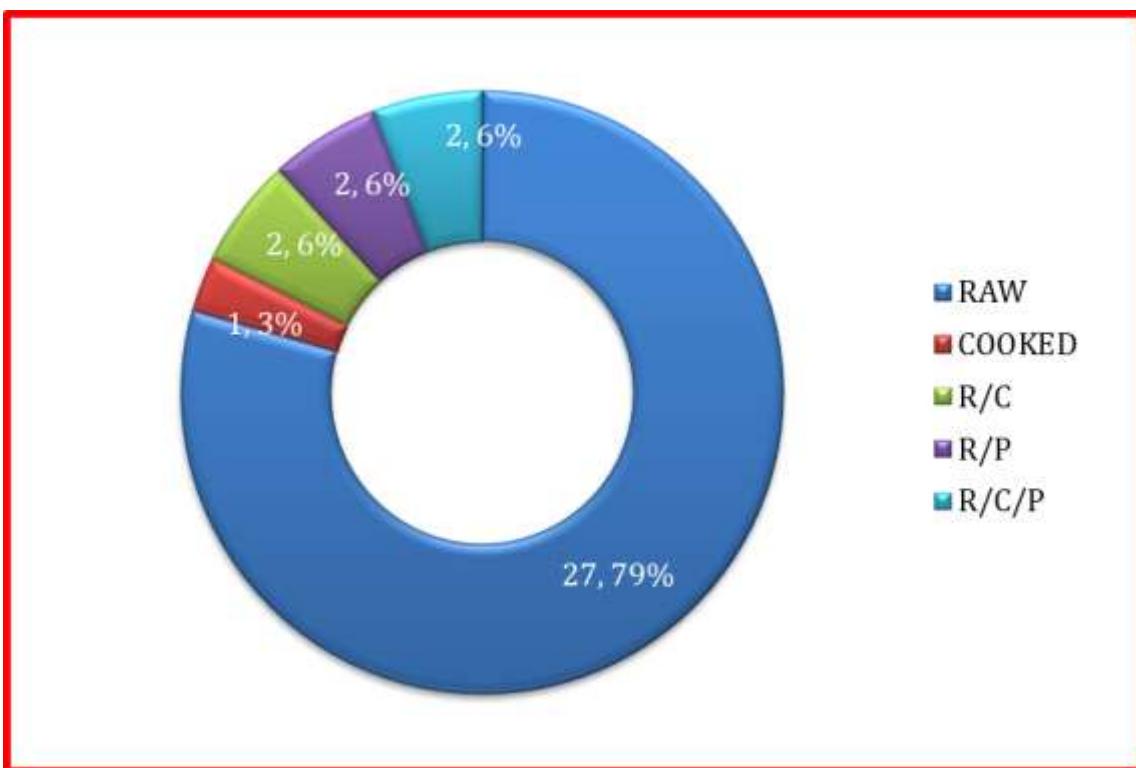


Figure 6: Post harvest consumption of WEF percentage distribution

**Table 1: Plant name, familsy, vernacular name, habit, fruit types and mode of use**

PLANT	VERNACULAR	HABIT	C/W	TPYE	MODE
<i>Anacardium occidental</i>	Munthiri	T	W	D	R
<i>Mangifera indica</i>	Ma	T	C	D	R/C/P
<i>Annona muricata</i>	Mull-seetha	T	C	B	R
<i>Annona reticulata</i>	Seemai-seetha	T	C	B	R
<i>Annona squamosa</i>	Seethapalam	T	C	B	R
<i>Carissa carandas</i>	Kalakai	T	W	B	R
<i>Borassus flabellifer</i>	Panai	T	W	D	R
<i>Phoenix sylvestris</i>	Echampalam	T	C	B	R
<i>Ehretia microphylla</i>	Vetrilai	S	W	B	R
<i>Opuntia dillenii</i>	Chappathikalli	S	W	P	R
<i>Carica papaya</i>	Pappali	T	C	B	R
<i>Pithcellobium dulce</i>	Kodikai	T	W	L	R
<i>Tamarindus indica</i>	Puli	T	C	L	R/C
<i>Citrullus lanatus</i>	Thaniapalam	C	W/C	P	R
<i>Coccinia indica</i>	Kovaikai	C	W/C	B	R/C
<i>Phyllanthus reticulatus</i>	Pulampalam	H	C	B	R
<i>Phyllanthus acidus</i>	Aranelli	T	C	B	R/P
<i>Phyllanthus emblica</i>	Nelli	T	C	B	R/P
<i>Artocarpus heterophyllus</i>	Palapalam	T	C	D	R
<i>Ficus glomerata</i>	Aththipalam	T	W/C	D	R
<i>Musa paradisiaca</i>	Valai	T	C	B	R/C
<i>Psidium guajava</i>	Koyya	T	C	B	R
<i>Syzygium cumini</i>	Naval	T	C	B	R
<i>Punica granatum</i>	Madualai	S	C	B	R
<i>Ziziphus oenoplia</i>	Sooram	S	W	D	R
<i>Zizyphus jujube</i>	Elanthai	T	W	B	R
<i>Morinda tinctoria</i>	Manjanathi	T	W	B	R
<i>Citrus limon</i>	Yalumichai	S	C	B	R/C/P
<i>Citrus medica</i>	Narththankai	S	C	B	R/C/P
<i>Aegle marmelos</i>	Vilvam	T	W	B	R
<i>Feronia elephantum</i>	Vilampalam	T	W	B	R
<i>Manilkara zapota</i>	Sapota	T	C	B	R
<i>Solanum nigrum</i>	Manathakkali	C	C	B	C
<i>Physalis minima</i>	Thoppipalam	S	W	B	R

**Table 2: Plant, ethnobotanical information and pictorial image of the edible part**

PLANT	ETHNOBOTANICAL INFORMATION
<i>Anacardium occidental</i>	Cashew nuts fruits are used for many purposes like blood sugar, weight loss, cancer, cold and flu, aging, urinary disorders, digestive disorders, and bone strength and relaxation
<i>Mangifera indica</i>	Fruit is invigorating and freshening. Juice is restorative tonic and used in heat stroke. The seeds are used

	in asthma and as an astringent.
<i>Annona muricata</i>	As anti-inflammatory natural products to treat inflammatory disorders for cancer prevention and therapy
<i>Annona reticulata</i>	Pulverized unripe fruit is used in the treatment of dysentery and diarrhoea
<i>Annona squamosa</i>	Fruit exhibit potential anti-oxidant activity, improve digestion.
<i>Carissa carandas</i>	Used for preventing heart disease, relieving digestive trouble and curing fevers.
<i>Borassus flabellifer</i>	The fruit has antioxidant and anti-inflammatory properties.
<i>Phoenix sylvestris</i>	Used to treat back pain, toothache, headache, arthritis, nervous debility and as sedative
<i>Ehretia microphylla</i>	Fruits used to treat cough, colic, diarrhea and dysentery.
<i>Opuntia dillenii</i>	Gonorrhea, whooping cough and constipation, control bile secretion, spasmodic cough and expectoration.
<i>Carica papaya</i>	Used in the treatment of warts, corns, sinuses, eczema, cutaneous tubercles, glandular tumors, blood pressure, dyspepsia, constipation, amenorrhea, general debility, expel worms & stimulate reproductive organ
<i>Pithecellobium dulce</i>	Used for the treatment of various gastric complications
<i>Tamarindus indica</i>	Fruit extract used to treat abdominal pain, diarrhea and dysentery, helminthes infections, wound healing, malaria and fever, constipation, inflammation, cell cytotoxicity, gonorrhea, and eye diseases.
<i>Citrullus lanatus</i>	Fruit is diuretic and useful for the treatment of dropsy and kidney stones, peel for diabetes and lower alcoholic toxicity
<i>Coccinia indica</i>	Used for diabetes, gonorrhea, constipation, wounds, anti-inflammatory
<i>Phyllanthus reticulatus</i>	Used to treat urination disorder, fever, smallpox, colic, constipation, diabetes
<i>Phyllanthus acidus</i>	Used to treat a wide spectrum of diseases such as inflammatory, rheumatism, bronchitis, asthma, respiratory disorder, hepatic diseases and diabetes
<i>Phyllanthus emblica</i>	Used to treat diarrhea, jaundice, and inflammation
<i>Artocarpus heterophyllus</i>	Fruits extensively used in traditional medicine due to its anti-carcinogenic, antimicrobial, antifungal, anti-inflammatory, wound healing, and hypoglycemic effects.
<i>Ficus glomerata</i>	Fruits are known to counter constipation and diarrhea; infertility
<i>Musa paradisiaca</i>	scourge of malnutrition; optimal functioning of the gastro-intestinal and digestive system; constipation
<i>Psidium guajava</i>	Fruits exhibit antidiabetic, antioxidant, antidiarrheal, lipid-lowering, and hepato-protection activities
<i>Syzygium cumini</i>	Fruits are endowed with anti-hyperglycemic, hypolipidamic, anti-inflammatory, cardio-protective, and antioxidant activities.
<i>Punica granatum</i>	Fruits are endowed with strong antioxidant activity and anti-inflammatory properties. Purifies blood;
<i>Ziziphus oenoplia</i>	Blood purifier, febrifuge, abdominal pain
<i>Zizyphus jujube</i>	Antimicrobial, anti-inflammatory, hypoglycemic, antioxidant, and immunomodulatory effects
<i>Morinda tinctoria</i>	Fruits exhibit anti-oxidant, anti-inflammatory, reduces hypertension, painful menstruation, arthritis, gastric ulcers, diabetes, and depression.
<i>Citrus limon</i>	Fruit is rich in vitamin C helps body to fight off infections and prevent scurvy; boost/ refresh body immune system.
<i>Citrus medica</i>	Fruit is rich in vitamin C acts as capillary protector, anti-hypertensive, diuretic, antibacterial, antifungal, anthelmintic, antimicrobial, analgesic, strong antioxidant, anti-cancer, antidiabetic, estrogenic, antiulcer, cardio-protective
<i>Aegle marmelos</i>	Diabetes: Take 15ml of leaf juice once in a day before food to manage diabetes and reduce excess urination. Constipation: Intake of 5gms of bilva fruit pulp mixed in a glass of butter milk or warm water twice a day to get relief from irritable bowel syndrome, constipation and indigestion.
<i>Feronia elephantum</i>	Fruit pulp has hypoglycemic and antidiabetic potential
<i>Manilkara zapota</i>	Fruits effective anti-inflammatory; gastrointestinal tract and averts the risk of enteritis, irritable bowel syndrome and gastritis
<i>Solanum nigrum</i>	Fruits used to treat pneumonia, aching teeth, stomach ache, tonsillitis, wing worms, pain, inflammation and fever, tumor, inflammation
<i>Physalis minima</i>	Used to treat cough phlegm, cold fever, sore throat, asthma